Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

mountainous walls and sharply serrated dividing ridges, while in the middle portion of the island there are broad expanses of rolling highlands which are drained by shallow channels, or short steep gulches.

The high massive cliffs along parts of the coasts and around some of the largest valleys are probably due to the fact that the upper thousand feet of the ancient volcanoes consisted of superimposed sheets of dense lava, beneath which are breccias and tuffs which yield much more readily to erosion and permit the overlying massive portions to be undermined. From the great depth of the sea off the coast and within the bays, as well as from the absence of coral reefs or of extensive sea shelves, it appears probable that these islands have been submerged to a considerable depth within comparatively recent times.

IN RELATION TO THE EXTENT OF KNOWLEDGE CONCERNING THE OCEANOGRAPHY OF THE PACIFIC

By G. W. Littlehales

U. S. HYDROGRAPHIC OFFICE, WASHINGTON, D. C.

Read before the Academy, April 17, 1916. Received, May 24, 1916.

The body of water whose oceanography is under discussion is of an extent so vast that its area exceeds by 10,000,000 square miles the total land surface of the globe, and its cubical content is estimated to be seven-fold greater than all the land above sea-level. The indications are that throughout nine-tenths of its expanse the depths are greater than one mile, and throughout three-fourths of its expanse the depths are greater than two miles. It is the field of the interplay of many different forces exercising an important influence in terrestrial physics, and presents a realm of unsurpassed promise for the fruits of investigation.

The accumulated oceanographical observations in the Pacific relate principally to the surface and the bottom. Even these are deficient, and the intermediate depths have been much less investigated. The materials from centuries of voyaging and from the expeditions for sounding the ocean sent forth since the last quarter of the nineteenth century, when deep-sea soundings first began to be taken in the Pacific, have provided information of the general distribution of barometric pressure and winds over this vast tract and also of the general aspects of surface circulation, temperature, and salinity; but the details of these matters have scarcely been touched. Until the tides have been gauged in the open ocean away from the land, it is not likely that a clear solution of the tidal problem will be completed. Despite the tidal observations hitherto gathered on the islands of the Pacific and on the coasts of the countries bordering this ocean, the means for the construction of the cotidal lines are either wanting or deficient in many parts.

The manuscript sheets of the Bathymetrical Chart prepared by the Hydrographic Office of the Navy Department, containing all the authentic deep-sea soundings, show the small extent to which the basin has been sounded and the distribution of bottom deposits made known, and prove the inadequacy of existing measurements to define the general contours of configuration. Even the continental shoulder is imperfectly known around most of the ocean circuit. In the North Pacific there is a tract twice as large as the United States which has been crossed by only a single line of bottom soundings about 250 miles apart; and in different parts of the Pacific other tracts as large as the continent of Australia remain entirely unfathomed. The majority of soundings are grouped in two lanes running respectively from the United States to Australia and from the Hawaiian Islands to the Philippines and Japan. No trustworthy contours of equal depth can be drawn beyond the continental shelf, because of insufficient information. Where knowledge is so imperfect, surprises should be in store for those who have accepted the representations appearing in depth-maps of the Pacific in which the isobathic contours have been courageously supplied. The soundings have generally been spaced too far apart to admit of conclusions in relation to even the grosser aspects of the orography, and hence the shape of nearly one-half of the earth is little known.

The deposits on the floor of the ocean have been reached at relatively few points and have generally been penetrated only to the depth of a few inches. The dearth of knowledge of their thickness and stratification makes it desirable to devise methods of bringing up a core several feet long. Although it is extremely doubtful whether these deposits have any analogues in the terrestrial rocks, the interest in the evidences of their stratification arises on other grounds. For instance, if a layer of red clay in great depths should be found overlying a layer of globigerina ooze, the induction would be that the floor of the ocean at this station had once occupied a position at a less depth below the surface of the ocean than the one in which the red clay was deposited; and this would bear strongly on great problems of crustal deformation.

The few records of serial temperatures and of the analyses of water taken from various depths, show that the Pacific bears a close resemblance to the other oceans in the general distribution of temperature, salinity, and density. That is to say, the waters have a gradual increase in density from the surface to the bottom, a gradual decrease in salinity from the surface to the bottom, and a gradual decrease in temperature from the surface to the bottom. But the details of the distribution of these quantities is unknown; of their variations from season to season and from year to year few observations have been made in the depths of the Pacific, and there is as yet very limited knowledge of the import of such changes upon the variations of climate and of physical and biological oceanography.

The observational foundation for investigating the ocean from the standpoint of thermodynamics requires the study in detail of definite stations occupied in concert and periodically revisited for the purpose of observing, as nearly as possible at the same time, such physical conditions, at certain depths, as the temperature, the salinity, the gas-content, and the currents; and in this way affording the means of presenting in the form of synoptic charts the changing network of lines of equal values of the physical elements in their distribution in the depths.

To sum up our thoughts, we may fix attention (1) upon the basin, of which no model can be at present constructed; (2) upon the deposits, whose thickness and stratification still remain unrevealed; (3) upon the waters, whose variations in physical conditions have not yet been sufficiently observed to explain the inner mechanism by which they operate to produce their effects in the economy of the earth.

MARINE METEOROLOGY AND THE GENERAL CIRCULATION OF THE ATMOSPHERE

By Charles F. Marvin

U. S. WEATHER BUREAU, WASHINGTON, D. C.

Read before the Academy, April 17, 1916. Received June 13, 1916

Stations for the surface observation of meteorological conditions are now numerous in the principal civilized countries of the world, and within the past twenty-five or thirty years explorations and investigations of the free upper air have been actively conducted at a number of places on land. In a few instances soundings of the air have been made on the North Atlantic ocean and in waters adjacent to Europe under the initiative of the late A. Lawrence Rotch, Teisserenc de Bort, and others. As a whole, however, little is known in detail of the meteorology of the oceans, except as revealed by the simple observations of weather and wind which many merchant and naval vessels have been accustomed to report for a number of years while plying their regular